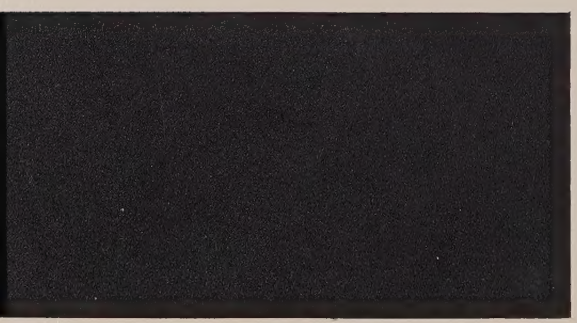
INSTRUCTION MANUAL

1015

THE BIRTCHER CORPORATION INSTRUMENT DIVISION
1200 MONTEREY PASS ROAD, MONTEREY PARK, CALIFORNIA



MODEL 70

SEMICONDUCTOR TEST SET

BASIC UNIT

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SECTION 1

GENERAL DESCRIPTION

INTRODUCTION

The Birtcher Model 70, 70A, and 70RM semiconductor test sets are the basic units for an accurate, versatile semiconductor test system when used with Birtcher 10-series plug-in modules.

The three basic units differ in construction and primary voltage supply. The Model 70 is a bench-top unit with cabinet; the Model 70RM is a rack-mounting version of the 70. The Model 70A has the same construction as the 70, but contains an auto-transformer for operation on 115, 220, or 240 VAC lines, 50 to 60 Hz.

All three units contain the basic voltage and current supplies, metering, and overload protection circuitry for the plug-in modules. Power and test controls and the semiconductor test jacks are located on the front panel and a connector at the rear provides for a remote test reset switch.

SPECIFICATIONS

The electrical characteristics of all three versions of the basic unit are the same; the physical characteristics vary as given below:

TEST POTENTIALS AVAILABLE:

Automatically made to 10-series module plugged in. For voltages and currents available for use with special module and blank module kit, see Section 3.

MODULE INTERCHANGEABILITY:

All 10-series modules are operable and accurate in any 70 series basic unit.

METER ACCURACY:

$\pm$ 1% full-scale (50 uamp), $\pm$ 1/2% linearity.

OVERLOAD PROTECTION:

Overload Protection circuit located in basic unit with overload sense line automatically made to particular module. Semiconductor disconnected when overload sensed and remains disconnected until manually reset.

SPECIFICATIONS (Cont'd)

CONSTRUCTION:

Aluminum alloy chassis. Anodized aluminum front panel. 70 and 70A have cast aluminum bezel and semi-gloss baked enamel cabinet.

WEIGHT:

70 and 70RM, approximately 25 pounds; 70A, approximately 30 pounds.

DIMENSIONS:

70 and 70A: 10 inches high, 19 inches wide, 17 inches deep; 70RM, standard 10-1/2 inch rack panel, 15 inches deep.

PRIMARY POWER:

Model 70 and 70RM are 115 VAC, 60 Hz, approximately 150 watts; Model 70A is 115, 220 or 240 VAC, 50 to 60 Hz, approximately 150 watts.

FUNCTIONS OF CONTROLS AND METERS

Upper Adjustment Control:	Provides continuous adjustment of test potentials available on current supply
Upper Meter:	Provides indication of voltage or current available from current supply (ranges are selected on module).
Lower Adjustment Control:	Provides continuous adjustment of test potentials available on voltage supply.
Lower Meter:	Provides indication of voltage or current available from voltage supply (ranges are selected on module).
Power Switch:	Controls power to Model 70 and plug-in modules.
Power Pilot Lamp:	Indicates power on.
Test Switch:	Controls potentials supplied to semiconductor under test and resets overload circuit.
Reset Lamp:	Indicates overload condition.

SECTION 2

INSTALLATION AND OPERATION

GENERAL

The basic semiconductor test set may be used with any Birtcher Corporation type 10 plug-in module for a wide variety of tests. In addition, blank plug-in kits are available for making up special modules.

INSTALLATION

The Model 70 and 70A may be placed on any horizontal surface. The Model 25 Test Cart provides for a convenient mobile test station and also holds up to six plug-in modules ready for use.

The Model 70RM mounts in any standard rack panel. If the 70RM is mounted in a roll-around rack, chassis rails are recommended.

Chassis grounding to power line is made through the standard 3-pin power connector; use a 3-pin to 2-pin plug adapter for line isolation.

For the 70A only, set the primary voltage selector switch (located on back), to the line voltage.

OPERATION

Each module manual contains instructions for operation with any of the basic test set versions.

SPECIAL MODULE CONSTRUCTION AND OPERATION

Blank Plug-In Kit #20046 is available for customer construction of special test modules. This kit contains a blank chassis, panels, all hardware, and the module connector.

The power outputs available from the basic unit are described in Section 3.

SECTION 3

THEORY OF OPERATION

GENERAL

The schematic diagram shows the circuitry of the basic unit. The circuitry is composed of the test jack connections, metering, overload protection circuit, and the voltage, current, and auxilliary power supplies.

CIRCUIT DESCRIPTION

TEST AND METERING CIRCUITS

The TEST JACKS and both METERS are made directly to the module connector. The module wiring will determine where these connections are specifically located in relation to the device under test.

VOLTAGE SUPPLY

Transformer T103 is tapped at several voltages and these taps are generally selected by Voltage Range Switches in the module. Auto-transformer T104 is the LOWER ADJUST control and is used to vary the voltage applied to the primary of T103.

CURRENT SUPPLY

T102, D103, D104, and C103 supply DC and AC to the plug-in module current source circuitry. Potentiometer R103, the UPPER ADJUST control, is included in this supply, since it is generally used to adjust the current source circuitry in the module.

PROTECTION CIRCUIT

Test control and overload protection are combined in the circuit of S102, Q101, and Q102. Each module contains a relay to connect the semiconductor under test to the TEST JACKS; the module relay is powered by the DC voltage from D101, D102, and C101 through TEST switch S102 and the normally closed contacts of K101 to Pin 15 of the module connector. The module relay is not operable until S102 is closed.

Pin 14 of the connector is the overload sense line of the protection circuit. Q102, a unijunction, is normally not conducting until the voltage at Pin 14 exceeds 4 volts positive in relation to Pin 13. When this occurs, Q102 conducts and the voltage drop across R101 triggers the SCR, Q101, into

CIRCUIT DESCRIPTION (Cont'd)

conduction and relay K101 picks up, opening the module relay line of Pin 15 and disconnecting the test semiconductor. The SCR will remain conducting until the circuit is reset by opening S102 RESET position of the TEST switch.

The module performs the proper connection of the sense line to the test circuitry.

AUXILLIARY POWER

Transformer T101, in addition to supplying power to the protection circuit, supplies AC power to the module for filament and plate supplies within the module.

Primary power is also made to the module through Pins 2 and 3 for individual module power supplies.

SHIELDING AND GUARDING

The TEST JACK leads and the voltage supply tap leads are shielded for isolation from electrostatic and stray ground-loop pickup. This guarding permits low leakage current measurements.

The chassis of the basic unit is grounded through the primary power ground pin.

MODEL 70A CIRCUIT DIFFERENCES

The 70A differs from the 70 in that auto-transformer T105 is included to permit operation from 115, 220, or 240 VAC lines, 50 to 60 Hz. The taps on T105 for these voltages are selected by the slide switch on the rear of the unit.

CONNECTIONS AND POWER OUTPUTS FOR BLANK MODULE

GENERAL

The following information is presented for use with customer-constructed modules using Birtcher Blank Plug-In Kit #20046.

CONNECTIONS AND POWER OUTPUTS FOR BLANK MODULE (Cont'd)

TEST JACKS

Accurate voltage measurements at the collector and emitter of a transistor operating at high currents may be done by using the diode lines. Birtcher test adapter #20011 has these connections made at the collector and emitter clips.

The following module connector pins are made to the test jacks:

Pin 43, 44:	Emitter (J105)
Pin 45:	Emitter Voltage Sense or Diode Cathode (J101)
Pin 41:	Base (J104)
Pin 38, 39:	Collector (J103)
Pin 37:	Collector Voltage Sense or Diode Anode (J102)

The wiring and TEST JACKS are designed to withstand 1500 VDC at the diode connections and 300 VDC at the transistor connections referred to the shields, Pin 36, or to the chassis with Pin 36 grounded.

VOLTAGE SUPPLY OUTPUT

The following voltages are available from T103, one at a time, referred to connector Pin 26:

Pin 28:	6.5V @ 3 A
Pin 29:	13.5V @ 3 A
Pin 30:	28V @ 1 A
Pin 31:	85V @ 300 MA
Pin 32:	250V @ 100 MA
Pin 34:	750V @ 30 MA

Voltages given are no-load, RMS, with primary at 117 VAC RMS. Currents are DC maximum with resistive load. Winding to frame insulation is 2.5 KV DC.

CURRENT SUPPLY OUTPUT

AC output at Pin 21 to Pin 23 is 25.2 VAC RMS, CT, at 1 A DC maximum; voltage output is no-load at 117 VAC RMS primary voltage.

CONNECTIONS AND POWER OUTPUTS FOR BLANK MODULE (Cont'd)

DC output at Pin 19 (+) to Pin 20 (-) is 17 VDC, no-load, 3 A DC load maximum at 117 VAC RMS primary voltage.

PROTECTION CIRCUIT

Pin 13 is negative common. Sense line, Pin 14 requires 4 to 5.5 VDC, positive, for overload trip. Relay output line, Pin 15 is 6 to 8 VDC, 400 MA maximum. Relay output line active only with TEST switch in TEST position.

AUXILLIARY POWER

The following voltages are available from T101, simultaneously, in RMS volts (no-load) and maximum DC current with resistive load: all at 117 VAC RMS primary:

Pin 10 to Pin 12:	360 VAC CT @ 50 MA
Pin 7 to Pin 9:	12.6 VAC CT @ 2 A
Pin 4 to Pin 6:	12.6 VAC CT @ 2 A

Interwinding and winding to frame insulation capable of withstanding 2.5 KV DC.

SECTION 4

MAINTENANCE

INSTRUCTION MANUAL

A Birtcher instruction manual usually contains hand made changes to diagrams and parts lists and sometimes tests. These changes are generally appropriate only to the instrument for which the manual was prepared. These hand made corrections show changes to the instrument that have been made after the printing of the manual.

There is a serial number on the warranty page of this manual. This is the serial number of your instrument. Be sure the manual number matches the instrument number when you order parts.

NOTE: Always include the instrument type and serial number in any correspondence regarding the instrument.

REPLACEMENT PARTS

Standard Components: Birtcher will supply replacement components at current net prices. However, since most of the components are standard electronic and radio parts, you can probably obtain them locally faster than we can ship them to you from the factory in Monterey Park, California. Be sure to consult the parts list to see what tolerances are required.

Birtcher Manufactured Parts: Birtcher manufactures almost all of the mechanical parts and some of the components used in the instrument. If you order a mechanical part, be sure to describe the part completely to prevent any unnecessary delay in filling your order. When you have any questions about mechanical parts or Birtcher manufactured components, contact our nearest field sales representative, or write to the service department at the factory in Monterey Park, California.

REMOVAL OF INSTRUMENT FROM CABINET, MODEL 70 AND 70A

The main chassis is held in place by 4 screws located on the rear of the cabinet. To remove the cabinet, set the instrument face down on a padded surface taking care not to scratch the bezel. Remove the screws and lift the cabinet upward and free of the chassis. Replacement of the cabinet is just reverse of the removal procedure.

SECTION 4

MAINTENANCE

PREVENTIVE MAINTENANCE AND TROUBLE SHOOTING

The test set is simple and straightforward, only the meters require a regular calibration check. Meter calibration procedures are found below.

To trouble-shoot the power supplies of the basic unit, the no-load voltages given on page 6 should be present within ± 5% with a 117 VAC RMS line.

The module connector should be checked periodically for presence of foreign objects and metal particles, especially if modules are changed often or the basic unit is stored with no module plugged in.

The relay should be checked periodically to make certain it operates freely. Contacts may be burnished if necessary.

CALIBRATION

Calibration is required only for the meter circuit total resistance. A series potentiometer adjusts for the variations in meter internal resistance. The total meter circuit resistance value must be correct for proper calibration of plug-in module current measuring circuits.

Connection to the meter circuits may be made via an Amphenol 57-10500 connector. Refer to the schematic diagram for connections.

EQUIPMENT REQUIRED

A calibration circuit is given in Figure 4-1. This circuit is chosen as being the most compatible with a minimum of laboratory equipment. Other circuits and equipment may be used, provided they are able to attain the required accuracy.

1. Regulated power supply capable of 10 volts at 60 milliamperes.

2. Precision differential voltmeter capable of measuring 125 millivolts to ± 0.1% or better; John Fluke Model 825A or equivalent.

3. 10% tolerance resistors of 2.2 ohms, 82 ohms 1 watt, and 100 ohms 1 watt, variable.

   NOTE: The resistance values may be lower than indicated, but at least 50 milliamperes must be flowing in the circuit for the required accuracy.

CALIBRATION (Cont'd)

CALIBRATION TEST SET-UP

The meters are connected as indicated in Figure 4-1. The 100 ohm variable resistor is adjusted for 125 millivolts across the 2.2 ohm resistor with the aid of the differential voltmeter. The series potentiometer in the basic unit is then set for full-scale indication.

NOTE: Birtcher part number 40978 meters, used on Model 70 instruments have external shunt resistors added. These have been factory selected to give 50 microamperes full-scale.

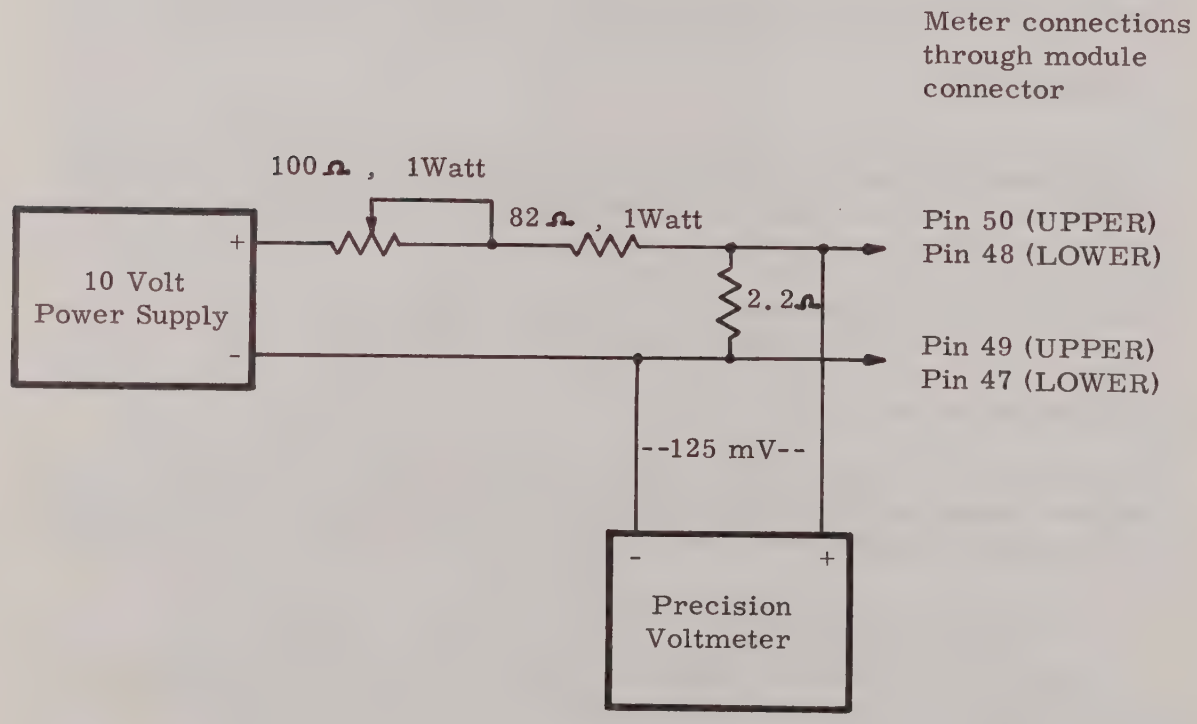


FIGURE 4-1

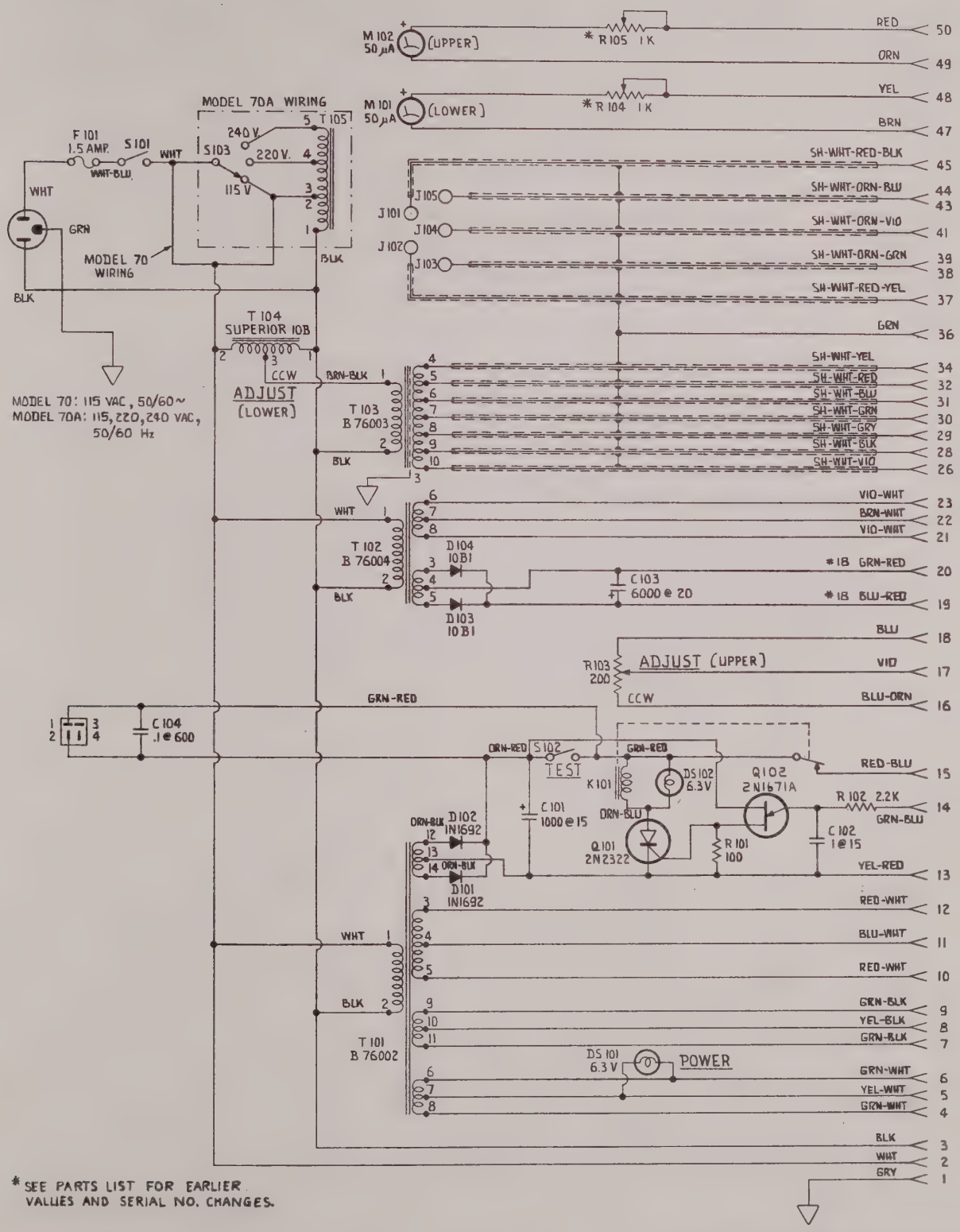
METER CALIBRATION CIRCUIT

SECTION 5

PARTS LIST

REFERENCE DESIGNATION	DESCRIPTION	BIRTCHER PART NUMBER
CAPACITORS		
C 101	1000 MFD @ 15 VDC	40068
C 102	1 MFD @ 15 VDC	40069
C 103	6000 MFD @ 20 VDC	40055
DIODES		
D 101	Semtech SC1	40553
D 102	Semtech SC1	40553
D 103	International Rectifier 10B1	40619
D 104	International Rectifier 10B1	40619
LAMPS		
DS 101	6.3V, Bayonett Base	41315
DS 102	6.3V, Bayonett Base	41315
FUSES		
F 101	1-1/2 Amp, Slow-Blow, 3AG	40109
RELAYS		
K 101	SPDT, 6 VDC	40157
METERS		
M 101	Microammeter, 48ua $\pm$ 1%	40978
TRANSISTORS		
Q 101	2N2322 SCR	40625
Q 102	2N1671A Unijunction	40449
RESISTORS		
R 101	100 ohms, 1/2W, $\pm$ 10%	40168
R 102	2.2K ohms, 1/2W, $\pm$ 10%	40199
R 103	200 ohms, 4W, Variable	41060
R 104	1K, 1/2W, Variable	40708
R 105	1K, 1/2W, Variable	40708

REFERENCE DESIGNATION	DESCRIPTION	BIRTCHER PART NUMBER
SWITCHES		
S 101	SPST Rocker Switch, Carling TILA 60	40572
S 102	SPST Momentary Rocker Switch Carling TILA 6A	40573
S 103 (Model 70A only)	DP3T, Slide, H.H. Smith 1054	40496
TRANSFORMERS		
T 101	Power Transformer	40711
T 102	Current Supply Transformer	40713
T 103	Voltage Supply Transformer	40712
T 104	Variable 125 VAC Auto-transformer	40516
T 105 (Model 70A only)	Auto-transformer	40786
CONNECTORS		
	Module Connector, 50 Pin Female	40101
	Remote Test Switch Connector, 4 Pin Female	40103



* SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NO. CHANGES.

4. RESISTANCES IN OHMS.
3. UNDERLINED CONTROL DESIGNATIONS APPEAR ON FRONT PANEL.
2. CAPACITANCES IN μfd.
1. RESISTORS, ½W, ± 10%, CARBON.

NOTES: UNLESS OTHERWISE SPECIFIED.

REV.	DESCRIPTION	DATE	DWN.	APP'D
F	R104, R105 WERE 500 Ω, WIRE COLORS ADDED	5-20-'65	L.H.A.	RM
E	REDRAWN	2-10-'65	E.B.	

REVISIONS

BIRTCHER CORPORATION — INDUSTRIAL DIVISION

MODEL 70 & 70A
SEMICONDUCTOR TEST SET
SCHEMATIC

DRAWN: E. Bodeman	APP'D: R. Mack	DIST.	REV.
DATE: 2-10-'65	DATE: 5-20-65	5	F

WARRANTY

All our products are warranted against defects in materials and workmanship for one year from the date of shipment. Our obligation is limited to repairing or replacing parts which prove to be defective during the warranty period. We are not liable for consequential damage.

For assistance of any kind, including help with instruments under warranty, contact your authorized Birtcher sales representative for instructions. Give full details of the difficulty and include the instrument model and serial number. Service data or shipping instructions will be promptly sent to you. There will be no charge for repair of instruments under warranty, except transportation charges. Estimates of charges for non-warranty or other service work will always be supplied if requested before work begins.

Serial Number: 70
70A
70RM